

COMMERCIAL LANDING AND FISHING MÉTIERS WITHIN THE ARTISANAL FISHERY OF TYRE, LEBANON

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1 Introduction

Artisanal fishery is the most important fishing sector of the Mediterranean for number of vessels and fishermen involved. The Lebanese fisheries may be classified in the artisanal/small-scale sector: they are mainly based on bottom-set stationary gears as trammel nets, gillnets and longlines, whereas floating longlines and purse seines for small pelagic fish are used to a lesser extent. Fishing operations, with the exception of longlines, are mostly at depths up to 50 meters.

According to official data in the study area (Tyre, South Lebanon) a number ranging from 400 to 550 fishermen and about 250 small boats (representing 9% of the whole Lebanese fleet), are involved in fishing activities. The main fishing gears are fixed nets and bottom longlines; the other fishing techniques used by the fishermen all along the year are purse seines and spear guns.

Despite the importance of the fishing sector in the area, no quantitative studies and no surveys were conducted in view of evaluating the status of resources. This information is indispensable to identify the needs of the fishery sector for consequent planning and management purposes.

Aim of this report is to provide qualitative and quantitative information on the artisanal fishery of Tyre providing information about fishing métiers¹, fleet composition, commercial landing, importance of Red Sea migrants in the catch composition and income data.

¹ With the term fishing métier, it is intended a combination of fishing gear, target species and fishing area.

2 MATERIALS AND METHODS

The study area, Tyre, is located about 83 Km south of Beirut. The coast has a typical Eastern Mediterranean climate having relatively cool rainy winters and hot dry summers. Water salinity is about 39‰. Inshore water temperature ranges from a maximum of 32°C in August to a minimum of 17°C in February. Limestone base rock headlands dominate wave-washed terraces and a series of gravelly and sandy bays. The continental shelf is narrow rarely exceeding 8 kilometres and it is cut by submarine canyons that may plunge 1 500 meters or more to gently sloping margins of the basin.

Data on artisanal fisheries were collected monthly from February 2005 to December 2006. During the sampling day the following data were collected on a sub-sample of the active vessels:

- landing by species (kg/vessel);
- information on the used gear (type, length, mesh size);
- information on the fishing areas (depth, sea bottom features);
- incomes by fishing activity (\$/boat).

For every daily survey, the daily catch for each vessel and for each fishing métier were calculated. Fleet official data (tonnage, length, engine power, material used, year of construction, year of inscription and type of fishing license), were obtained from the Ministry of Agriculture, Department of Fisheries & Wildlife.

The fishing métiers of the area are described in their technical features (gear type, mean dimensions, mesh size) and pattern of use (target species, fishing areas, periods, catch composition).

Information on the earnings for fishing activity was gathered. The economic performances of the vessels were calculated for each boat on the basis of transactions between fishermen and fishmongers. Generally, in Tyre, the fishermen sell all their catch to an only fishmonger who will market further the product.

3 Results

3.1 Fleet structure

According to the official statistics fishing fleet of Tyre fluctuates, depending from the season, from 215 and 250 vessels. The bulk of the fleet (70%) is made up by vessels of 7-9 m length (Figure 1) and 20-50 hp (Figure 2). The average gross tonnage of the vessels is 4.24 tonnes whereas the average power of the engines is 22.68 hp. The average age of the fleet is 19 years.

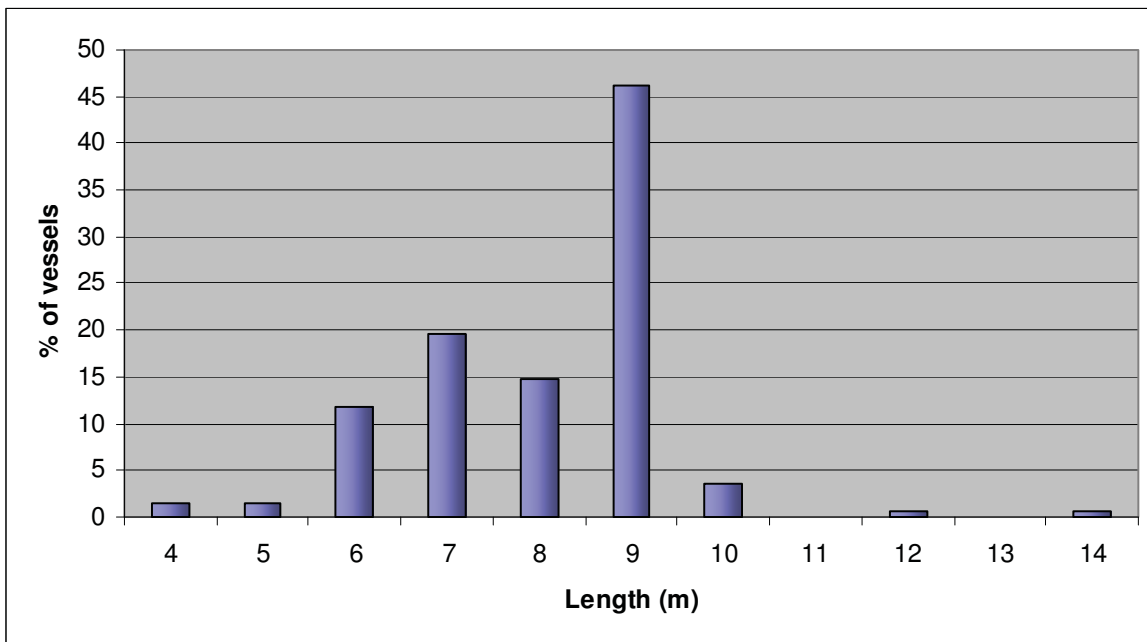


Figure 1: Observed length of the fishing boats observed in the port of Tyre

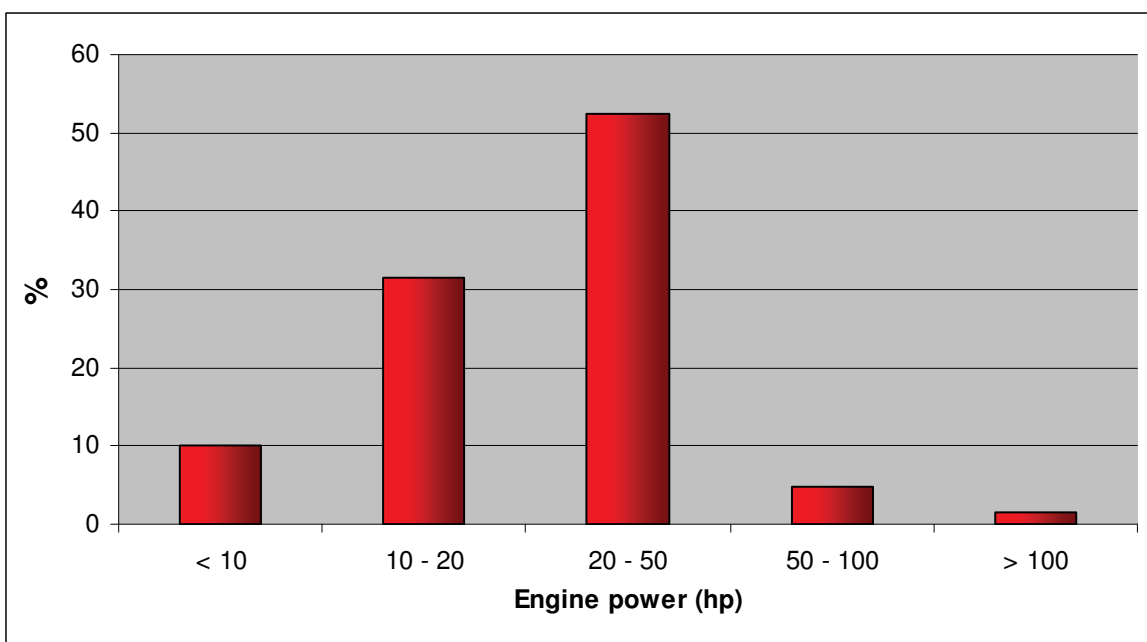


Figure 2: Observed engine power of the fishing boats in the port of Tyre

In effect, the observed active fishing fleet consists of approximately 175 vessels with a total length ranging between 4 and 14 m, powered by inboard engines ranging from 10 to 100 hp.

Vessels are typical wood boats (99%), powered with old engines usually bought second-hand. 36% of the vessels have a mechanical winch on the deck, whilst 1% utilize hydraulic winches: generally the longliners do not mount any kind of winch on the deck. The crew on board of each vessel is made up of 1 to 4 fishermen.

The fishing area is limited within 3 nm from the shoreline for 74% of the cases. Only 9% of the vessels works between 6 and 12 miles from the coastline (Figure 3).

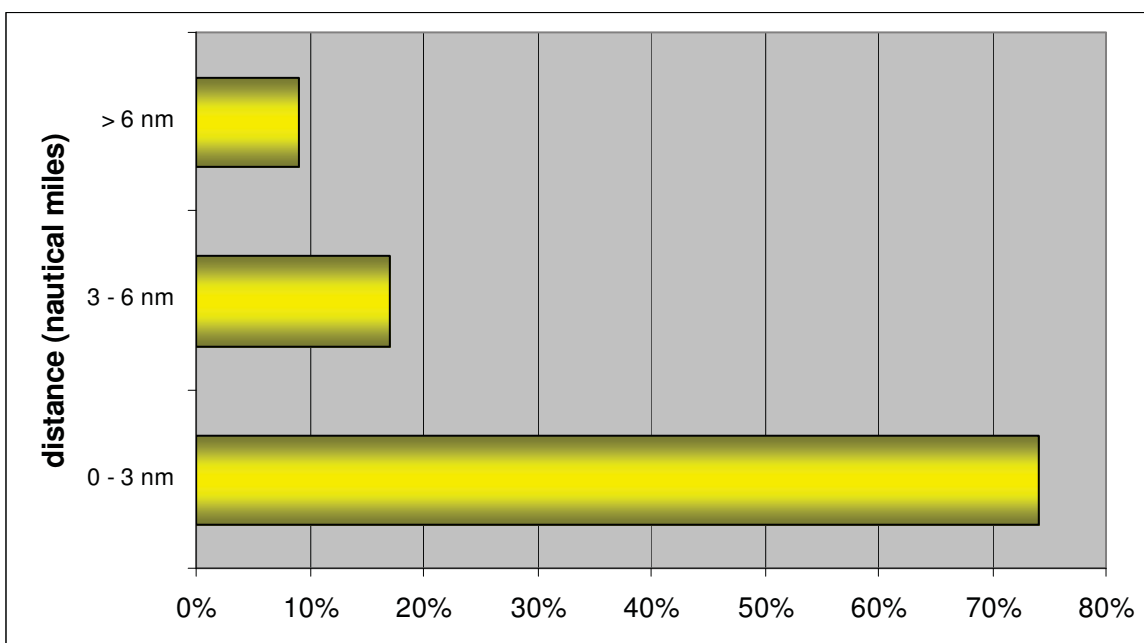


Figure 3: Fishing area of the fishing fleet of the port of Tyre

3.2 Fishing methods

About 2/3 of the fleet uses mainly fixed nets (both trammel nets and gillnets with different mesh size), 30% bottom longlines. Purse seines, floating longlines and other fishing gears have a limited use (Figure 4). Vessels show often on board the occurrence of more than one gear (i.e. trammel and gillnets) which are used in the same day.

Approximately 17% of the Tyre's fishing fleet uses **trammel nets** 300-1 500 m long and 1.2 - 2 m high at depth between 5 to 50 m targeting mainly demersal species such as red mullets (*Mullus barbatus*, *M. surmuletus*) and goat fishes (*Upeneus moluccensis*, *U. pori*). In spring, some fishermen use these nets in order to target big individuals of red striped mullet (*Mullus surmuletus*) and European hake (*Merluccius merluccius*). A trammel net

consists of three walls of netting, the two outer walls being of a larger mesh size than the loosely hung smaller-meshed inner netting panel.

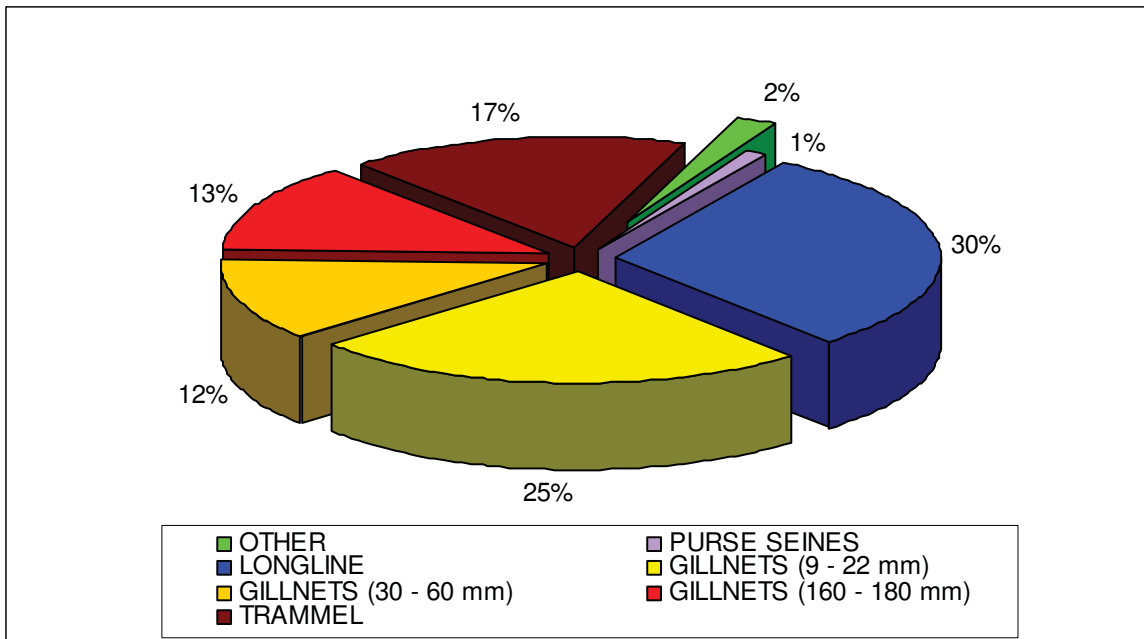


Figure 4: Fishing gears used in the port of Tyre

Fine mesh gillnets (a single wall of monofilament net with 9 – 22 mm mesh size), targeting small nektobenthic species (*Spicara smaris* and *Boops boops*) (Figure 5), are used by the 25% of the fleet. The length and height of this net may reach 2 Km and 3 m respectively. The fishing area is located between 10 and 50 m depth.

The Lessepsian pelagic species *Etremeus teres* is one of the most common by-catch species.

Medium mesh size gillnets (a single wall of monofilament net with 24 – 60 mm mesh size) target medium size nektobenthic species such as sparids (*Diplodus vulgaris*, *D. annularis*) and siganids (*Siganus rivulatus*, *S. luridus*) on shallow sandy and mixed sandy-rocky bottoms. The length of these nets ranges from a few hundreds meters to more than 1 Km, their height is up to 3 m. In some period of the year, multifilament nets with medium sized mesh are used for targeting small barracudas (*Sphyraena* spp.) or medium sized pelagics such as *Euthynnus alletteratus* and *Pseudocaranx dentex*.



Figure 5: Fishermen working at gillnet fine mesh sized full of gobbos (*Spicara smaris* and *Boops boops*)

Large mesh gillnets (a single wall of mono or multifilament net with 160 and 180 mm mesh size) are used to catch mainly medium sized pelagic fishes, as the Spanish mackerel *Scomberomorus commerson* and little tunny *Euthynnus alletteratus*. By-catch is made up by high-priced sparids such as the common dentex *Dentex dentex*, the red banded sea bream *Pagrus caeruleostictus* and serranids (the groupers, *Epinephelus* spp.). This gear, used by 12% of the Tyre's fleet especially in winter, generally is less than 1 Km length and up to 13 m high.

Bottom set **longlines** are widely used (30% of the fishing activity) to catch high value fishes, such as sparids (*P. caeruleostictus*, *P. pagrus*, *D. dentex*, *Diplodus sargus*, *Diplodus cervinus*) and serranids (*Epinephelus marginatus*, *E. alexandrinus*). The sampled vessels were employing in the same fishing day more than one longline (2-3 per vessels) each of 200-300 hooks.

Few vessels in Tyre port are equipped with **purse seines**. This gear mainly target common pelagic species such as the sand smelt (family Atherinidae) and the sardinella *Sardinella maderensis* but also the Lessepsian *Herklotsichthys punctatus*. The yields of this net may fluctuate strongly day by day according to sea conditions, fluctuation in local abundance fish shoals, etc.

Less used fishing methods are **traps**, filled with algae in June and July to target siganids (*Siganus* spp.), **spear gun** to catch seabream belonging to the genus *Diplodus* and groupers (*Epinephelus* spp.) and **floating longlines**, used to target groupers during May

and June and little tunny in autumn. Table 1 includes a complete review of the gears in use in port of Tyre, with month of use, target and most considerable by-catch species.

As far as fishing effort is concerned, almost all vessels (95%) operate all year long.

Table 1: Characteristic of the fishing métiers in Tyre with respective: gear, local name of gear, fishing period, mostly caught species.

GEAR	LOCAL NAME	PERIOD (MONTHS)	MAIN SPECIES
TRAMMEL NETS	Mbattàn	I – XII	<i>Mullus barbatus</i> , <i>Mullus surmuletus</i> , <i>Pagellus erythrinus</i> , <i>Pagellus acarne</i>
TRAMMEL NETS	Mbattàn	I – XII	<i>Penaeus japonicus</i> , <i>Portunus pelagicus</i>
MONOFILAMENT GILLNETS (9 – 22 mm mesh size)	Mbattàn	I – XII	<i>Boops boops</i> , <i>Spicara smaris</i> , <i>Mullus barbatus</i> , <i>Mullus surmuletus</i> , <i>Pagellus erythrinus</i> , <i>Etrumeus teres</i>
MONO/MULTIFILAMENT GILLNETS (24 – 60 mm mesh size)	Mbattàn	I – XII	<i>Diplodus</i> spp., <i>Siganus luridus</i> , <i>Siganus rivulatus</i> , <i>Adioryx ruber</i>
MONOFILAMENT GILLNETS (24 – 60 mm mesh size)	Mbattàn	II – IV	<i>Merluccius merluccius</i>
MULTIFILAMENT GILLNETS (24 – 60 mm mesh size)	Addì spherne	IX – X	<i>Sphyraena sphyraena</i> , <i>Sphyraena chrysotaenia</i>
MULTIFILAMENT GILLNETS (24 – 60 mm mesh size)	Addì balamida	XI – I; V – VI	<i>Euthynnus alletteratus</i> , <i>Pseudocaranx dentex</i>
MONO/MULTIFILAMENT GILLNETS (160 – 180 mm mesh size)	Addì ghazel	X-VII	<i>Scomberomorus commerson</i> , <i>Euthynnus alletteratus</i> , <i>Dentex dentex</i> , <i>Pagrus caeruleostictus</i> , <i>Epinephelus</i> spp.
PURSE SEINES	Addì sardine	I – XII	Atherinidae, <i>Sardinella maderensis</i>
TRAPS	Kfas	VI – VII	<i>Siganus luridus</i> , <i>S. rivulatus</i>
FLOATING LONGLINE	Jarjaara	V – VI; X-XI	<i>Epinephelus</i> spp., <i>Euthynnus alletteratus</i>
BOTTOM LONGLINE	Sharak	II – IV	<i>Merluccius merluccius</i> , <i>Scorpaena elongata</i>
BOTTOM LONGLINE	Sharak	I – XII	<i>Diplodus vulgaris</i> , <i>D. sargus sargus</i> , <i>Pagrus pagrus</i> , <i>P. caeruleostictus</i>
SPEAR GUN	Fared Sayd	I – XII	<i>Epinephelus</i> spp., <i>Diplodus vulgaris</i> , <i>D. sargus sargus</i> , <i>Octopus vulgaris</i>

3.3 Catch data

Landing data of 425 fishing vessels and 14 different fishing métiers were collected during the daily surveys. Table 2 shows the mean daily landing by vessel and the mean catch per unit of effort for the most common fishing métiers in use in the port of Tyre.

Table 2: Landings (kg/boat) of the main fishing métiers in Tyre

Fishing gear	Target species	Kg/boat	
		min	max
Trammel nets	<i>Mullus</i> spp. – <i>Pagellus</i> spp.	2.00	20.00
Gillnet (9 – 22 mm mesh size)	<i>Spicara smaris</i> – <i>Boops boops</i>	5.00	13.00
Gillnet (24 – 60 mm mesh size)	<i>Diplodus</i> spp. – <i>Siganus</i> spp.	3.50	25.00
Gillnet (160 – 180 mm mesh size)	<i>Scomberomorus commerson</i> – <i>Pagrus</i> spp.	4.00	12.00
Bottom longlines	<i>Diplodus</i> spp. – <i>Pagrus</i> spp.	1.50	11.00

The catch per unit effort is higher than 1.5 Kg/boat for all the gear considered. Gillnet with 9-22 mm mesh size for picarel (*Spicara spp.*) and bogue (*Boops boops*) and purse seine for small pelagic species show the highest yields (as weight of the catch per each boat).

3.4 Lessepsian species in the catch composition

During the studied period, a total of 25 Lessepsian species, representing 17 families and contributing to 30% of the total landing in the area, have been recorded to date. Among those, Siganidae (both *S. luridus* and *S. rivulatus*) contribute to the total landing with 13% in weight.

Both invading mullids, *U. moluccensis* and *U. pori*, form 35% of the mulled catch off the coast of South Lebanon at depths below 50 m. The Red Sea obtuse barracuda, *Sphyraena chrysotaenia*, has out numbered (more than 70%) the native sphyraenids in inshore gillnet and trammel net catches.

The pelagic species *E. teres* and *H. punctatus* constitute around 50% of the small pelagic landing.

The pufferfish *Lagocephalus spadiceus*, the sweeper *Pempheris vanicolensis* and the cornet fish *Fistularia commersonii*, represent common by-catch (around 50%) of different type of gillnets.

Spanish mackerel *S. commerson*, exploited mainly by large mesh size gillnet, is become abundant in recent years. By catch of longline (around 15%) is composed by crepuscular squirrelfish *Adioryx ruber*.

The Indo-West Pacific species *Nemipterus randalli*, exploited by small sized mesh gillnet, represents a recent by-catch along the Lebanese coasts.

Among crustaceans, *Marsupenaeus japonicus* (Figure 6), *Trachypenaeus curvirostris* and *Trachysalambria palaestinensis* compose most of the prawn catch (95 %) off the south Lebanese coast.



Figure 6: The Lessepsian species *Marsupenaeus japonicus*

Catches of an early invader, the swimming crab *P. pelagicus* (1.5 % of total landing), are still increasing.

3.5 Income data

Income data of seven fishing activities were gathered on 216 vessels. 8% of the sampled vessels shows on board the occurrence of two gears. These occurrences, referred as “combined nets”, include: gillnets fine mesh size and trammel nets, gillnets medium and large mesh size and, in one occasion, trammel nets and traps for targeting siganids.

The activity, and consequently the incomes, fluctuates strongly during the year depending on weather conditions, yield of target species, market prices and other conditions.

Table 3 shows the daily income per vessel and per fishing activity of the sampled boats. In order to better understand the dynamics of the economic performances, catch per vessels per fishing activity are presented.

Table 3: Daily income (US \$) and catch per vessel by fishing activity of the 216 sampled boats

Fishing activity	Sampled boats	Catch per vessel (Kg/boat)	Income per vessel (\$/boat)
Combined nets	17	14.15	40.65
Trammel nets	48	7.14	27.43
Gillnets (fine mesh)	64	17.77	46.96

Gillnets (medium mesh)	25	13.64	43.82
Gillnets (large mesh)	16	7.33	49.74
Longlines	35	5.53	34.10
Purse seines	5	83.23	45.63
Traps	6	5.12	26.91

Despite the relatively low yields in weight, gillnets with large mesh size provide the best incomes (almost 50\$ per boat per day) due to the high commercial value of both target and by-catch species (Figure 7).

Gillnets (fine and medium mesh size) and purse seines show relatively high incomes as well, whilst the trammel nets give the lowest incomes.



Figure 7: The high commercial value species, common dentex (*Dentex dentex*) caught by means of gillnet with large mesh size

4 Discussion

The fishing activity in Tyre appears to be fairly diversified and designed to exploit a wide range of species in the coastal area. The proportion of vessels going fishing every day on the total fleet is very high showing that artisanal fishing is still a primary economic activity, contrary on what is happening in many European Mediterranean countries where artisanal fishery has reduced its economic importance for coastal communities.

The fleet is composed by old vessels, generally up to 9 m length, with old and not very powerful engines; 2/3 of the vessels are not equipped with winches to pull the nets on board and a lack of equipments do not insure security on board. Vessels usually accomplish daily trips occasionally using more than one gear in the same day. The fishing effort results mainly concentrated in the coastal area for the exploitation of littoral species with fixed nets and longlines. The lowest yields are those of smaller vessels using trammel nets in very shallow fishing grounds. Data on yield or catch per unit of effort of the vessels show a very heterogeneous situation with strong daily fluctuations both in the quantity and in the quality of the fish landed.

Results presented as Lessepsians reveal a qualitative and quantitative importance beyond their percentage in the catch composition of Tyre fishing fleet, with several migrants become common in the local landing and market. The percentage of Lessepsian migrant species observed in the study area (around 20%) is higher than the overall percentage (14 %) of Lessepsian migrant fishes in the entire Eastern Mediterranean, suggesting that different populations are now well established. Moreover the presence of the tropical migrant *Nemipterus randalli*, previously unknown by local fishermen, indicates a recent rapid colonization along the Lebanese coasts.

High percentage of Red Sea fishes found in the Tyre area indicates that, at least more resistant species had form well settled population. The role of this newly settled species within the coastal ecosystem and its impact on local populations need to be the object of future research.

The economic performances of the fishery sector in Tyre reveal high fluctuations, as far as landed product, daily incomes and yields per fishing activity concerned. The high commercial value of some target and by-catch species provide excellent economic performances for the fishermen using gillnets with large mesh size. Gillnets (fine and

medium mesh size) and purse seines show relatively high incomes as well: it has to be bore in mind however, that these fishing activities need at least two crew members on board. On the contrary, the longliners, who use to fish as the only member on the vessel, may be satisfied also from lower incomes. The lowest performances are observed for the trammel nets, which usually provide lower but constant incomes.

Fixed costs for the fishermen are related to vessel and gear maintenance, whilst the variable costs include mainly fuel and other costs related to the baiting of longlines and some kinds of gillnets.